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15:01:41####Corso di Fisica II

Prova scritta del 29/01/09 I° modulo

Esercizio 1

Per risolvere questo problema utilizziamo il principio di sovrapposizione:

consideriamo cioè la sfera

grande senza cavità, poi sottraiamo gli effetti (campo o potenziale) dovuti a

una sfera carica in

corrispondenza della cavità.

In generale il campo elettrico di una sfera uniformemente carica è:

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rispettivamente 8R per la sfera grande e 1R per quella piccola)

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suo esterno.
Per poter sommare i campi elettrici dobbiamo esprimere
i due campi in funzione della stessa
variabile, diciamo r: quindi il campo della sfera piccola va trasformato in
funzione di r.
Poiché è richiesta l ' espressione del campo totale solo lungo la congiungente i
due centri, possiamo
lavorare sui
moduli dei vettori
che abbiamo definito.
Dividiamo il disegno in 7 regioni per mezzo delle linee tratteggiate, numerando
da sinistra.

Per ognuna delle regioni valutiamo l ' espressione

$s=s(r,K)$

e utilizziamo i campi opportuni.

Regione I

$s=r+K;$

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Regione II

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Regione III

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Regione IV

$s=-r+K;$

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Regione V

$s=r-K;$

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Regione VI

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Regione VII

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Si noti il cambio di segno nelle regioni III e IV:

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 sono discordi.

Si

noti anche

il cambio di segno

dalla regione IV alla V: ne risulta che il campo totale è costante in cavità (si osservi la forma

esplicita dei campi costituenti).
Viene richiesto il lavoro per portare
un elettrone
dal centro a un punto sulla superficie. Tale lavoro
non è
uguale per tutti i punti: bisogna scegliere e indicare il punto considerato.
Qui viene proposta la soluzione per i punti A e B indicati in figura.
In questo caso non viene richiesto il potenziale in ogni punto: è quindi
possibile studiare la
soluzione con
i lavori (o i campi o i potenziali, a scelta) dovuti alle due sfere nei
rispettivi sistemi di
riferimento, prestando attenzione alle dovute trasformazioni.

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Esercizio 2

Si vuole che gli elettroni non passino la lastra con campo magnetico: la condizione fisica è quindi

che la lastra sia spessa almeno quanto il raggio di larmor, data l'energia degli elettroni e il

campo

magnetico.

La

forza di Lorentz è :

B

v

q

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M
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o

La forza centripeta per un corpo in moto circolare uniforme è:

r
mv
F
C
2
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Nel nostro caso la forza centripeta è data dalla forza di Lorentz; velocità, raggio e campo magnetico sono tutti perpendicolari tra loro. Possiamo quindi eguagliare le due formule (considerando i moduli delle grandezze) e scrivere l ' espressione per il raggio di Larmor (caso non relativistico):

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con i dati forniti.
Per ricavare la velocità abbiamo utilizzato

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